UNDERSTANDING ENTERPRISE RISK ACROSS AN AQUISITION PORTFOLIO: A GROUNDED THEORY APPROACH

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Abstract

Every acquisition program contains risks. But what impact do these risks have on the entire portfolio of acquisition activities? What does risk at the Enterprise level really mean? For example, risk collectively could portend great danger to the acquisition manager's overall portfolio which might be otherwise masked by traditional program performance and analysis. Alternatively, these risks also might represent opportunities to achieve greater results when analyzed from a portfolio perspective. Initial review of the literature suggests that most leaders are unable to articulate the risk carried by their portfolio of product development activities or what this means to them. However, the same literature suggests they strongly desire this capability. Beginning with a review of the applicable literature in the areas of risk, product development (acquisition) and product portfolio management, portfolio-level risk applications are found to be sparse and ill-conceived. Initial analysis of interviews with portfolio leaders involving military product development activities in portfolios of large, complex, system development will be presented with a discussion of the implications of enterprise risk for product portfolio management.

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Motivation

DoD programs have been having problems because they "do not capture the requisite knowledge when needed to efficiently and effectively manage program risks" according to the US Government Accountability Office (GAO) [**1**]. Not only has Risk been identified by the GAO; others (Rebentisch and Seering; Murman, et al) [**2, 3**] see risk as a major driver of problems in product development and as an area ripe for improvement. Miller and Lessard were among the first to call for a more explicit linkage of risk to the management of large-scale engineering projects [**4**]. The outcomes of these efforts speak for themselves. Biery documented cost and schedule growth for several hundred different kinds of projects and mixed portfolios over the course of several decades [**5**]. He found that in large, complex, socio-technological systems, cost and schedule growth was more often the rule than not. For example, US DoD programs averaged about 40% schedule growth and approximately 50% cost growth [**5**]. From an enterprise perspective, since the 1970s, total budget overruns for DoD system development of at least 30% has been the norm and is increasing [**6**]. Drug improvement projects, electricity generation projects, and mining projects, to name a few, experienced even greater cost and schedule growth than did US DoD programs, sometimes up to 500% [**5**]. Similar findings against different data sets have been produced by Flyvbjerg, et al [**7**] and Miller and Lessard [**4**].

Several authors have suggested managing product portfolios as a way to improve product development [**8, 9**]. The GAO encourages better portfolio management for the DoD as a way to deal with the inherent risks and uncertainties encountered in weapon system development [**10, 11**]. The GAO highlights the portfolio impacts of risk as one that will result "in a reduction of the department's buying power" [**1**]. Managing risk together with portfolio management is now the overriding mantra coming from the GAO [**1, 12, 6**] and also RAND [**13, 14, 15, 16**].

Bringing the concepts of risk and portfolios together may be more difficult than it seems. Shapira noted that among most executives surveyed, aggregation of risk is very rarely done and although desirable, is usually considered too hard to do [**17**]. A recent RAND study agreed with both sentiments [**15**]. However, Aloysius, in discussing R&D projects, suggests that firms can consider projects collectively and that risk aggregation helps in resource decisions [**18**]. Using aggregated risk and portfolios together could be used to hedge information uncertainty when making decisions, which Krishnan and Ulrich describe as the essence of product development [**19**].

Risk, Risk Management, and Product Development Portfolios: A Literature Review

The literature reveals much theoretical work has been done to link risk to product development projects. By extension, the literature discusses using risk in portfolios at the enterprise level of product development (PD).

A sampling of the literature shows the definition and meaning of risk is often muddled. Among the general meanings of risk, there are competing definitions of risk depending upon the perspective of the various disciplines [**20, 21, 22, 23, 24, 25, 26**]. However, the common elements of these definitions revolve around probabilistic inputs leading to uncertain outcomes.

In product development literature, several kinds of specific risk are enumerated, such as: schedule, performance, development cost, technology, market, and business risk [**27**].

McManus and Hastings add categories of risk such as: disaster, failure, degradation, market shifts, need shifts, extra capacity, and emergent capabilities [**28**]. Miller and Lessard enumerate additional kinds of risk, particular to megaprojects, and equally applicable to DoD Acquisition efforts [**4**]. These are program stability risk, economic environment risk, and optimism risk. There are even the process-oriented categories of risks of operational, design, manufacturing, and performance according to Chase [**29**]. Finally, let's not forget interdependencies which can comprise a distinct category of risk [**23**]. Lessard and Miller further cautioned that "risks are multidimensional and thus need to be unbundled for clear understanding of causes, outcomes, and drivers" [**30**].

Keizer, et al, recently addressed risks in new product development (NPD) using a multi-dimensional approach [**31**]. They sought to demystify the various kinds of NPD risks along the lines of technological, business, and organizational risks. They developed taxonomy of nearly 142 "risks" clustered into 12 main risk areas. These risks contain three variables of interest: likelihood, impact, and ability of the product development team to influence the risk within their constraints. These 12 categories are: Organization and Project management risks; Commercial viability risks; consumer acceptance and marketing risks; Product family and brand positioning risks; Manufacturing technology risks; Product technology risks; Supply chain and sourcing risks; trade customer risks; competitor risks; public acceptance risks; intellectual property risks; and screening and appraisal risks [**31**].

Keizer's enumeration of risks corresponds nicely with Williams' earlier bibliography of research relating to project risk management [**32**]. Among the risks in PD identified were: time risk, cost risk, performance risk, and the contractual aspects of risk [**33**]. Notably, Williams also acknowledges the hand of multiple disciplines (Management Sciences, Operations Research, Engineering, and Psychology/Decision analysis) in shaping the concepts of risk important to projects. He further proposed adding another dimension to the traditional understanding of risk (impact vs. probability), 'predictability,' in order to distinguish between the outcomes of an intrinsically uncertain situation (aleatoric probability) and outcomes relating to a measure in belief of a proposition (epistemic probability) [**32**]. This observation opens the door to understanding risk from a psychological perspective. Kahneman and others have identified the notion of "framing" as a way for us to take mental shortcuts in dealing with complex and risky issues which leads decision makers to discount extreme events because the probability is too low to evaluate intuitively [**34, 35, 36, 37, 38**].

In essence, there are nearly as many kinds of risks as there are ways to describe risk and care must be taken on how it is represented. There is general agreement in the literature about the kinds of risks common to PD. Effectiveness of risk mitigation activities, however, is difficult to demonstrate because it depends on un-provable counterfactuals [**39**]. Managing, measuring and mitigating risk is essential to PD, but no clear consensus has yet emerged regarding how to do that. Miller and Lessard nevertheless suggest project outcomes are the most appropriate means to measure risk [**4**].

Risk Management

Given an understanding of the risks facing PD, several frameworks exist that suggest ways to manage risk for the product development practitioner. Most of them follow a pattern of risk identification, risk analysis, and risk disposition to describe risk management. Please see [**23, 40, 41**] for good examples of these frameworks. There are also many other frameworks that focus on a particular portion of these generic risk management frameworks and advocate using various tools and processes for that specific area within risk management. Bresnahan and Hastings & McManus for instance, each have differing frameworks for approaching risks depending on task at hand or the phase (initial concept, prototype, final design) of a project in the product development cycle [**42, 28**]. Frame elaborates on this by saying "the risks a product encounters vary dramatically over its life [**23**]. For example, risks encountered in the investment phase are quite different in content and impact from those encountered in the maturity phase."

Oehmen made an important observation about risk management and the larger product development enterprise [**43**]. He extended the common risk management frameworks beyond their traditional boundaries by adding two framework elements that are ignored or otherwise assumed by most other frameworks: the monitoring of risks and the integration of risks. The 'integration of risk' element implies methods by which management pulls together the "big picture" regarding overall risk. This element should capture the cause and effect network effects among and between multiple projects. 'Monitoring of risks' is the framework element describing how management is informed of specific project risks. He documents and describes over 57 different risk management methods and where they are most applicable to be used (for example, FMECA). However, only one method out of the 57 is associated with the integration element. This method is called scenarios and is mentioned briefly elsewhere by Miller and Lessard [**4**]. No explicit method is identified with the 'monitoring' element. Furthermore, he postulates 'aggregation' as a method to use at the enterprise level to manage risk. Shapira agrees with his assertion, but both are devoid of specifics [**17**]. Given the above, Oheman's framework seems to imply a link to portfolios of projects and their management, but no further elaboration is given.

Portfolio Management is a Kind of Risk Management

The benefits of using portfolios in product development should include: having a good balance of projects (promoting a mixture of possible outcomes and a mixture of projects across the development lifecycle); and the right number of projects in development (a place to make go/no-go decisions, relating to managing the capacity of the product development system) [**8, 4, 44, 2**]. These two concepts of balance and capacity suggest other risks that portfolio management implicitly should handle as part of its approach.

Additional evidence suggests even more kinds of risk. Fricke and Shenbar show how resource allocation and flexibility play the dominant role in a multi-project environment, consistent with other multi-project management research [**45**]. Pich, Loch and De Meyer model individual projects as activities resulting from choices [**46**]. The underlying variable is the information provided depending upon the information environment. Gutierrez and Paul discuss the role subcontracting mechanisms play on project success

[**47**]. These papers touch on other portfolio implications for risk (resource allocation, flexibility, choice, information, and contracting mechanisms) not previously mentioned that exist in large portfolios.

Nevertheless, several portfolio management tools and techniques have emerged over time using traditional project financial information. These include the Growth-share matrix (Boston or BCG matrix), the GE multi-factoral analysis (McKinsey matrix), the advantage Matrix (another BCG matrix), the Ansoff Product-Market Growth matrix and the Contribution Margin Analysis method [**48, 49, 50, 51, 52, 53, 54, 55**]. Cooper, Edgett, and Kleinschmidt report that among product development firms, however, these techniques, which use financial indicators (NPV, iRR, etc.) are the least effective in outcome prediction and control [**8**]. Nevertheless, these are often the most employed, perhaps reflecting management's familiarity with such tools. Management dissatisfaction with these financial-based tools, however, remains high [**8**].

Risk Literature has evolved to contribute many more methods to portfolio settings. Not surprisingly, these methods are extensions of those seen in project risk management. Most of the classical engineering and operations research approaches used for project risk can also be used here. These methods tap a wide spectrum of disciplines and use a wide variety of tools and processes, ranging from simple list-keeping (awareness) to more formalized approaches.

Simple lists and matrices such as those advocated by Bettis & Hall [**56**] and Fiegenbaum & Thomas [**57**], bubble diagrams as discussed by Cooper [**58**], dependency matrices as discussed by Dickinson [**59**], criteria selection [**60**], and using value vs. variance [**61**], quantify risk through a mix of qualitative and quantitative methods. These methods share some likeness to existing traditional approaches.

Some aggregation (additive) methods also exist. Garvey uses an index to measure an overall system's performance risk by normalizing all the technical performance measures within a project and then adding them up to give an overall risk index [**62**]. However, no portfolio level application using this method has yet been noted. Bozeman & Rogers use a simple aggregation of the number of articles, patents, and algorithms resulting from a portfolio of R&D activity to indicate the risk associated with that portfolio [**63**]. Parametric comparison of similar projects using historical data is also a form of aggregation. However, these go beyond simple mathematic formulations. One such method is reference-class forecasting taken from the field of behavioral psychology [**64, 65**]. Another method correlates "complexity" (a heuristic-defined term based upon various system attributes) with cost and schedule of projects and finding a threshold that when passed results in failure of projects [**66**].

A favorite method among practitioners to compare projects is adopting multi-attribute utility theory (MAUT) methods. There is an entire body of literature devoted to these methods, including extensions to portfolio selection, mostly drawing from operations research. For example, Lévárdy & Browning use the notion of schedule risk, cost risk, and technical performance risk, each weighted by a specific value, and then added together to denote the risk of a project [**67**]. Extending this method to a portfolio of projects is problematic because comparing dissimilar risks between projects is difficult. Aloysius proposed using an expected utility framework to show that aggregation of risk would reduce risk aversion for the efficient selection of joint projects by a consortium [**18**]. Browning & Eppinger discuss MAUT methods at length, including the drawbacks of its complexity and the amount of data required for accurate modeling of risk [**68**]. The largest limitation noted is that metrics can be gamed and the choice of the utility function is an important key to its interpretation.

More sophisticated approaches include the use of: Real Options [**69, 70, 71**], System Dynamics [**72, 73**], Shannon Entropy or Information theory [**74, 75, 76, 77**], Model Predictive Control [**78, 79**], Control-theoretic forms [**80**], and Decision-theoretic approaches [**81, 82, 68, 38, 83, 84, 85, 48, 49, 86, 87, 88**]. Several of these methods incorporate the use of triangular probability distribution functions to represent worse case, most-likely, and best case risk expressions. Notably, all of the above portfolio frameworks assume clear portfolio choices and risks are known a priori and do not (and cannot) account for day-to-day uncertainties and emerging risks or opportunities.

Enterprise Risk and Portfolio Execution

As noted, researchers have devoted the greatest measure of their time and attention to the selection and optimization of project portfolios. Every method assumes the execution of each portfolio happens within the bounds of the original assumptions. However, McDonough & Spital reveal a different perspective of portfolios [**89**]. They suggest after initial portfolio decisions are made, the execution of these decisions, (the "how"), plays a great role in determining PD success. Granted, individual project performance does make a difference to the overall success of the portfolio, but the "actual efficiency of project portfolio management has, so far, been a rare topic of study" [**90**]. McNamara & Bromiley agreed and noted there is a pressing need to "measure" risk as decision makers use it in a portfolio [**91**], while Ruefli, Collins, & Lacugna lament the decline of studies looking into risk at this level of analysis [**92**].

Stanke's framework for high-performing enterprises defines performance of the enterprise as a combination of three items: alignment, efficiency of execution (agility), and effectiveness of outcomes (flexibility) [**93**]. Agility is the ability of an enterprise to address known issues, flexibility is the ability to address unknown issues, and alignment is the behavior, both system and individual, that enhances agility and flexibility. In an ideal sense, a portfolio is successful when it is able to address known and unknown issues and promote strategic behaviors. Westerman and Hunter [**94**] outlined another enterprise framework including agility as an enterprise risks. They also drew a distinction between 'Enterprise risks' (the things that the C-level of a corporation cares about) and 'risk factors' (the things that are managed at lower levels, including individual program risks).

Research Design

Despite the existence and the proliferation of risk and portfolio methods, improvements in PD outcomes for large, complex systems, has not materialized. To find evidence about PD outcomes, better understand portfolios and enterprise risk, an exploratory survey of portfolio leaders was undertaken during the summer of 2007 at Hanscom Air Force Base (AFB)[1].

Portfolio management is the preferred method to manage product development in the US Air Force and is diffused down the hierarchy of acquisition leadership – through wing, group, and squadron commanders. It was hypothesized that understanding the capabilities of portfolio leaders would yield the most valuable and interesting information. These capabilities were described as the "levers of control" that leaders have to wield influence and authority. The questions asked, "What is the current 'state of the practice' of portfolio management in the US Air Force? How is risk being used in portfolio management activities in the US Air Force? What behaviors or constructs can be observed in US Air Force acquisition that might be described as influenced by enterprise risk?" Other questions asked about decision-making, surprises, dependencies between programs and other topics.

The format was an open-ended, semi-structured interview. Purposeful sampling was used in the construction of the interview set. This method was chosen since "portfolio" management is done by a limited number of individuals within the US Air Force. Allowance was made to accommodate and allow snowball sampling.

Interviews were limited to organizations that physically reside at Hanscom AFB, the home of the Electronic Systems Center (ESC), which is the acquisition arm (e.g. product development center) for the US Air Force (USAF) electronic systems. It has been operational since the 1940s. 24 of 45 Squadron commanders (Level III leaders), 10 of 14 Group commanders (Level II leaders), and 4 of the 5 Wing commanders or their equivalent (Level I leaders) are located at Hanscom AFB. Therefore, given the above ground rules and constraints, there were approximately 38 potential interviewees at Hanscom AFB. A total of 18 people were interviewed (some interviews contained more than one person). The sample size represents 11% of all squadrons, 36% of all groups, and 75% of the wings assigned to Hanscom, or 21% of all local squadrons, 45% of all local groups, and 75% of the wings physically residing at Hanscom[2].

[1] Hanscom AFB follows a classic top-down organizational tree. There are four levels in the hierarchy. The lowest level (Level III) is a Squadron commander or equivalent, responsible for two or more programs or efforts. The next level (Level II) is led by a Group commander or equivalent, with the next level (Level I) led by a Wing commander or equivalent. The top level (Level 0) is the Center commander. Hanscom AFB has 5 Wings or equivalent organizations (Level I). Each wing contains 3 to 5 groups or similar organizations (Level II) and each group contains 2 to 6 Squadrons or similar organizations (Level III). The respective number of groups, and squadrons, etc., assigned to each wing is dependent upon the number of projects being managed. A Wing (Level I) consists of about 1200-1400 personnel and manages more than 2 dozen major programs and several dozen minor programs; a Group (Level II) has about 400-600 personnel; and a Squadron (Level III) has 100-200 personnel, and so forth.

[2] A caveat to ESC's representativeness in this survey is that it is responsible for the development of software-intensive systems & very limited in complex hardware development, with a few exceptions. Some of these exceptions were included in the initial interview pool – maintaining a wide cross-section of PD types – while also providing for a "reserve" of other interviewees with the same kind of PD breadth for a later date, if the need arose.

This paper assumes a basic understanding of US Air Force system acquisition[3]. An interesting dispersion of authority and responsibility for product development exists within the US Air Force. This reflects a number of checks and balances built into the system. In its most basic form, in the US Air Force, major commands, "MAJCOMs," have some selection and budget planning authority (with additional authority reserved at the US Air Force level or higher to be used for integration activities occurring at the US Air Force level, etc.)[4], the Secretary of the Air Force for Acquisition (SAF/AQ) is responsible for executing the portfolio, and Air Force Materiel Command (AFMC) (or a similar organization) is responsible for providing what is needed (in terms of personnel, buildings, office space, resources, etc.) to execute programs[5].

Observations and Analysis

Several key themes emerged from the interviews that cut across all levels of the hierarchy. These themes are money, personnel, or requirements, or some combination of all three impacting the outcome measures of individual programs, resulting in increasing costs and/or schedule slips.

Money is a key constraint for portfolio leaders. "Everything is really about the purse strings," opined a Group commander (Level II leader). By design, the government has placed restrictions upon the ways money can be used in programs. Most of these deal with preventing fraud and abuse. Some deal with the realities of fiscal policy and monetary/treasury realities. Many of the respondents were frustrated by not having more latitude to move money within their portfolio as needs required, or to even get the money expeditiously to their program personnel. "…we rely on a lot of other folks, particularly your MAJCOM, your air staff folks to get the money to come down," said a Squadron commander (Level III leader).

Personnel issues came up in two different dimensions. Portfolio leaders complained about the lack of people to fill key positions and/or the level of experience of existing personnel. "…we don't have all the right skill sets for the folks that are trying to run programs now. We have a lot of vacancies, or we don't have the right skill sets in programs," said one Squadron commander (Level III leader). A Group commander said, "It's the experience. And it really surprises me that we are allowing decisions to be made or making decisions based upon an experience-base that is not really, I think, adequate.

[3] Note: Strategic planning is often conducted by a MAJCOM – "a major command". "Market needs" and requirements are gathered from key stakeholders - "the warfighters", and formalized "capability" requirements are generated. The same MAJCOM will plan and budget for the development of these capabilities. (Please see [**95**] for a thorough examination of this process). There are many 'prickly' issues here, outside the scope of this paper, ranging from who pays for program personnel to how personnel & resources are allocated across AFMC. Furthermore, the dynamics of a 2 year planning & budgeting cycle, with yearly congressional appropriations, complicate matters further.

[4] Evidence exists that some portfolio selection & optimizations methods are used by the MAJCOMs. These vary in complexity & sophistication from MAJCOM to MAJCOM, ranging from lists ("roadmaps") to complex operational research applications. Please see [**95**] for further discussion.

[5] By comparison to the commercial world, a product development portfolio is usually the result of a strategic planning process, balancing the identified needs and wants of projects with available resources prioritized strategically to align with the goals of the organization. The execution of the strategic plan is then carried out by the same organization.

I've got sharp, sharp people in here. Wonderful people but then I take a look and they don't have the experience."

This reality forces portfolio leaders to constantly evaluate and allocate manpower according to need. Said one Squadron commander (Level III leader), "…people you get are based on where they think the priorities are. You don't necessarily get the good ones if they don't think you're priority…" Another Squadron commander lamented, "…if they take my manpower, because then …I'm stuck, I have to focus on only my highest high-level stuff, my high-priority stuff."

The pressure upon personnel resources is exacerbated by instability among user priorities and requirements. Regarding priorities, a Group commander (Level II leader) shared this insight, "…the bottom line is it that at the end of the day that system is beholden to the user and the user only and it's their priorities versus the priorities of the enterprise that are going to win." Priorities and requirements are often intertwined and hard to distinguish. A thoughtful Squadron commander (Level III leader) observed the following, "I think the changing user and I won't just say requirements, because they don't even come as requirements, but fancies: "I want to do this today." "I think that's a great idea." Okay, in those great ideas, because if it is at the Pentagon and it may not even be the general who runs it, but his staff, when they have great ideas, it becomes like, you know, the 'birth.' It's…we're gonna shortcut everything and that's probably one of the biggest gripes I have, I'll tell you. We get considerable amount of re-taskings." Another Squadron commander (Level III leader) said, "The user will redirect us, so we do get some of that, more time stuff, we'll redirect some of our resources to do stuff like that." Finally, the user may try to direct things more than they should. "There's a lot of folks who have good ideas on how to solve a problem, not just work the problem which needs solved and they tend to help us out with solutions as well as requirements and that's a struggle that we have on a regular basis" said one Group commander (Level II leader).

Within the portfolio structure, there were some issues that depended upon the level a leader occupied in the hierarchy. One example revolved around the perceived value of staff personnel. At levels closest to the program work, there was doubt expressed about the value-added of these personnel. At higher levels, staffs were seen as a 'last line of defense' to ensure accuracy of program information that would be reviewed at higher levels. One Squadron commander (Level III leader) said, "Working the staff, I think, is the hardest part. I think that is the most difficult part. The commanders, I think, they're pretty good, once you can get through their staff and get on their calendars."

Further, at higher levels of responsibility, commanders felt completely empowered to do whatever needed to be done to ensure portfolio success. Further down the hierarchy, commanders felt more constrained. Upon closer examination, 'completely empowered' might be too optimistic. All of them used words such as "influence," "shape," and "work with" to describe their portfolio capabilities. This was particularly true for high-visibility programs, ACAT 1 programs, or other programs under scrutiny by outside parties.

Another noted difference among the hierarchy was that the further removed leaders were from the day-to-day work of individual programs, the more time they spent thinking strategically. The converse was true for Squadron commanders (Level III leaders). "Honestly we're focused on what inch-stones are this month," said one Squadron commander.

Finally, another topic concerned the 'value' proposition perceived by Squadron commanders (Level III leaders) and program personnel. Non-essentials seemed to be over-emphasized compared to program outcomes. One Squadron commander lamented, "The fact that I haven't had my PHA [a health screening] or that I am late on gas mask training is a far bigger deal up the chain than whether or not one of my programs slip." Another Squadron commander echoed the same idea. "…there's so much, it seems, not associated with the primary acquisition mission that seems to carry a high level of performance, of measure, to determine your success."

In speculating about the root causes for these issues, it is clear that portfolio management and portfolio risk practices (knowledge of and use of) are variable and not standardized. The data reveals limited evidence of portfolio behaviors and little, if any, enterprise risk understanding. 92% of all those interviewed felt Portfolio Management was an 'art'. 42% acknowledged having no portfolio-level vision or strategy although another 33% claimed to have a vision or strategy. 33% of those interviewed want portfolio-level measures, while acknowledging difficulty in obtaining such measures.

Portfolio capabilities were explained by referring to individual project outcomes: performance (requirements), cost (resources), and schedule (time) and extrapolating this information to the entire portfolio. Therefore, they were not articulated in any kind of formal measures, but in more vague terms. A Squadron commander (Level III leader) said, "For me, it's done, it's really done as 'contentment' among the portfolio...and if I have that good feeling, I'm satisfied with the direction of the entire portfolio". A Group commander (Level II leader) suggested, "…my folks really don't have the ability to measure against their goals, other than saying I've got that vision or mission."

Without exception, all affirmed the use of risk data as essential, but were often at a loss to describe exactly how it was used. 75% of those interviewed used traditional risk tools (e.g. risk cubes, mitigation plans) for individual programs. 50% used program-level metrics to help make portfolio decisions and 42% used 'high-level' reviews to discuss risks of multiple projects – but without a structured process or integration of risks between projects. Most felt that these reviews were adequate in vetting the highest-level risks among programs, but that it was not overall very efficient (time-consuming).

The concept of portfolio risk was challenging for many. Almost all interviewed had a different definition and understanding of portfolio risk and what it meant for them. Only 25% of those interviewed claimed to have a set of portfolio risks and one leader had an integrating contractor managing those risks[6]. 42% said limited manpower prevented the use of portfolio risk management and 33% felt that the structure of their organization inhibited portfolio risk management.

Discussion

Portfolio Objectives within the Acquisition community of the US Air Force seem to be somewhat at odds with traditional portfolios. While it is true that portfolios serve as a categorization method, many of the current pairings of program to portfolio do not make sense. They often seem to have been made due to geographic proximity or budgeting categorization, not necessarily regarding a shared system commonality or other typical portfolio objectives. While portfolio leaders are expected to live within the resources available, they have little ability to adjust resources accordingly. Further, portfolios are also used as a reporting vehicle where good news is spread quickly and widely and bad news is often kept 'in house' as long as possible. Finally, emphasis is placed upon portfolio leaders to mentor the program managers in the art of program management. These are not necessarily bad things, but are also not representative of traditional portfolio management constructs.

Observed outcomes are also different than what might be expected from a portfolio management process. Cost, schedule and performance data for programs (and by extension, portfolios) exhibit huge instabilities, trending in undesired directions. Mismatches in strategy between programs and the portfolio are common: for instance, portfolio vision and focus can be diluted due to the cacophony of stakeholder voices and system inputs at all levels.

In this environment, systemic constraints and organizational constructs doom the leader to mediocre portfolio performance. They have few effective levers of control to influence portfolio performance. They have little capability to prune the portfolio or to 'throttle' the execution of existing programs (e.g. speed up, slow down). These controls are exercised elsewhere in the US Air Force. But they also occasionally serve in gatekeeper functions with a great deal of responsibility – as a Source Selection Authority, Milestone Decision Authority, or to function as an Award Fee Designating Official. As a program advocate, portfolio leaders become reputation managers, lobbyists, and information conduits. Perhaps their greatest area of influence exists at the start of new programs because they carve out the initial team of personnel and resources until the official processes 'catch up' with the new program. Perhaps the only lever of control totally within their purview is the contractual mechanism with industry. However, even this lever is constrained by financial pressures outside the control of the portfolio leader.

A dominant observation from these interviews is that portfolio leaders recognize everyone is working very hard. It would be very easy for them to "blame" personnel for most of the cost, schedule and performance issues, but they do not. They recognize

[6] The contractor was also interviewed. Although they had accepted the task of managing portfolio risks, determining those risks was proving to be very difficult & at the time of the interview, and after several months of effort, they did not yet have any portfolio risks enumerated.

people generally have the best of intentions and their actions are often focused by the system towards local optima versus global ones.

The emergent themes are not especially surprising. They reveal resources (people: not enough or skilled and money: highly constrained) and requirements (ranging from shifting priorities to re-taskings to preferred solutions) contribute to poor portfolio outcomes. The consequences of these issues manifest themselves through schedule and cost growth. However, they are not necessarily the root cause. The themes reflect a system that is constantly in a fire-fighting mode, trying to keep every project going despite an apparent lack of system capacity required to proceed. The result is programs that are constantly under financial and organizational pressures to do "more with less." Schedules slip and programs overrun their budgets.

Risk management practices observed are used at the project level with unsatisfying attempts to reconcile them to the portfolio level (hard to compare risks between projects). Current methods used appear to be very simplistic and not as robust as methods advocated by the literature or are in place "on paper" only.

Clearly, enterprise risks are not easily articulated. However, several potential candidates can be postulated as enterprise or portfolio risks. Using the Stanke [**93**]framework as a starting point, measures for agility, flexibility and alignment can be proposed. What are portfolio measures for agility? Perhaps acquisition process capacity (borrowing concepts from queuing theory) and process capability (skills and depth of personnel) might be good surrogate measures. Flexibility? A measure of a 'portfolio reserve' vs. total budgeted baseline, the percent of unused process capacity, and a portfolio leader's social network measures (such as centrality) might be good ways to measure it. Alignment? A subjective 'measure' of all programs in the portfolio to the overall strategy or measuring the strategic priority of the programs in the portfolio might work for alignment. Much more work is required to fully develop these ideas further.

The bottom line is that measures such as these do not currently exist. Many of the data required to develop such measures are not even collected (or are closely guarded). For instance, not one portfolio leader would divulge their manpower required estimates or their actual personnel numbers – only estimates between 70% and 90% were obtained. Overcoming obstacles like this will be critical in developing enterprise risk measures.

What then, should a program manager do, if they wanted to improve their probability of success? A tentative, short list is provided below. There is tongue-in-cheek humor here – but the suggestions are valid as long as the status quo remains the same.

1. Ensure your project has priority. This means having visibility where it counts – at the level of those that manage the priorities.
    a. Therefore, hope your system is a priority or badly broken, thus ensuring leadership attention.
    b. Or demonstrate real value the program brings by being fully-funded, etc, in terms the end customer that sets the portfolio priorities understands.

2. Understand the position of your project with respect to the rest of the portfolio; managing interfaces and information flow to prevent surprises and ensuring transparency, and doing everything possible to maximize financial execution.
3. Emphasis on networks of key players and advocates for your program is essential. This is across the user requirements & budget, resource (personnel), and financial execution communities.

What are the implications for current portfolio leaders? What portfolio management principles are best used in this current constrained environment? In no apparent order of priority:

1. Short-term levers of control, like moving of personnel will continue to be the preferred method used at the portfolio level.
2. Emphasize capacity constraints and resource shortfalls as often as possible ("be the squeaky wheel" without sounding like one)
3. Focus on removal of barriers to spending money for projects. This will head-off budget reductions; insist budget documents are broadly worded for maximum flexibility.
4. Longer-term levers of control, via budgeting, will be a constant concern. Ensuring 'unfunded' requirements and task orders are standing-by for quick funding is a practical strategy keep the overall portfolio healthy.
5. Recognize the controls vested in you are "processes of influence" – along all dimensions.
6. Program advocacy is a primary responsibility, both with the acquisition chain as well as to users and other stakeholders.
    a. This includes confidence-building and forming trust relationships
7. Attempt to deflect new or changed requirements as long as possible
8. Try to close out old activities and delay new work while maintaining current resource levels.

Conclusions

The 'state of the practice' of portfolio management in the US Air Force is poor. The current acquisition system is pre-disposed against portfolio leaders implementing portfolio best practices. Enterprise risk management and portfolios are used heuristically, at best, more often disjointed and disconnected from the overall portfolio. Enterprise measures are not in place. 'Current-state assessment' of process capacity is not available; personnel and other resource shortages are outside of the control of the portfolio leader. Outcome measures for the portfolio are based solely on individual project outcomes – not necessarily an 'optimal' approach to portfolio management.

Critical thinking about enterprise risk is in a nascent stage within the US Air Force. Using portfolio management and enterprise risk information to achieve greater value is worthy of additional research. Potential enterprise risk measures are not meaningful in their present form but have emerged as viable candidates for future study and hypotheses testing.

Development of a model of the overall US Air Force PD process, including those portions of portfolio responsibility and authority that do not reside in the acquisition system, is a logical next step towards understanding improving portfolio behaviors and identification and application of enterprise risk information. Coupled with a simulation of the suggested enterprise risk surrogates and their effect upon enterprise outcomes will shed light on the efficacy of using Enterprise Risk to assist managing US Air Force portfolios.

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